CAR RENTAL SYSTEM

A PROJECT REPORT

Submitted by

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in partial fulfillment of requirements for the award of the course

CGB1201 - JAVA PROGRAMMING

In

COMPUTER SCIENCE AND ENGINEERING

K. RAMAKRISHNAN COLLEGE OF TECHNOLOGY

(An Autonomous Institution, affiliated to Anna University Chennai and Approved by AICTE, New Delhi)

SAMAYAPURAM – 621 112

NOVEMBER- 2024

K. RAMAKRISHNAN COLLEGE OF TECHNOLOGY (AUTONOMOUS)

SAMAYAPURAM – 621 112

BONAFIDE CERTIFICATE

Certified that this project report on **“CAR RENTAL SYSTEM”** is the bonafide work of **THARUN S M(2303811710421170)** who carried out the project work during the academic year 2024 - 2025 under my supervision.

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Submitted for the viva-voce examination held on 6.12.2024

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INTERNAL EXAMINER	EXTERNAL EXAMINER

DECLARATION

I declare that the project report on “**CAR RENTAL SYSTEM**” is the result of original work done by us and best of our knowledge, similar work has not been submitted **to “ANNA UNIVERSITY CHENNAI”** for the requirement of Degree of BACHELOR OF ENGINEERING. This project report is submitted on the partial fulfilment of the requirement of the completion of the course **CGB1201 - JAVA PROGRAMMING.**

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[illegible]

THARUN S M

Place:Samyapuram

Date:6.12.2024

VISION OF THE INSTITUTION

To serve the society by offering top-notch technical education on par with global standards

MISSION OF THE INSTITUTION

- Be a center of excellence for technical education in emerging technologies by exceeding the needs of the industry and society.
- Be an institute with world class research facilities
- Be an institute nurturing talent and enhancing the competency of students to transform them as all-round personality respecting moral and ethical values

VISION OF DEPARTMENT

To be a center of eminence in creating competent software professionals with research and innovative skills.

MISSION OF DEPARTMENT

M1: Industry Specific: To nurture students in working with various hardware and software platforms inclined with the best practices of industry.

M2: Research: To prepare students for research-oriented activities.

M3: Society: To empower students with the required skills to solve complex technological problems of society.

PROGRAM EDUCATIONAL OBJECTIVES

1. PEO1: Domain Knowledge

To produce graduates who have strong foundation of knowledge and skills in the field of Computer Science and Engineering.

2. PEO2: Employability Skills and Research

To produce graduates who are employable in industries/public sector/research organizations or work as an entrepreneur.

3. PEO3: Ethics and Values

To develop leadership skills and ethically collaborate with society to tackle real-world challenges.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO 1: Domain Knowledge

To analyze, design and develop computing solutions by applying foundational concepts of Computer Science and Engineering.

PSO 2: Quality Software

To apply software engineering principles and practices for developing quality software for scientific and business applications.

PSO 3: Innovation Ideas

To adapt to emerging Information and Communication Technologies (ICT) to innovate ideas and solutions to existing/novel problems

PROGRAM OUTCOMES (POs)

Engineering students will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions

5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

ABSTRACT

The Car Rental System is an innovative software application designed to simplify and streamline the process of renting cars for both customers and rental companies. This system provides customers with a user-friendly platform to search for available vehicles, view rental details, and make reservations. Simultaneously, it empowers rental companies to manage their fleet efficiently, track bookings, and handle payments securely. With features such as an intuitive interface, fleet management tools, and online payment integration, the system ensures convenience, transparency, and reliability for all users.

The system leverages advanced Java programming concepts, including object-oriented programming principles, database integration, and API usage, to deliver robust functionality. Its modular architecture allows seamless enhancements, such as dynamic pricing, customer loyalty programs, and AI-based car recommendations. Furthermore, the system's scalability ensures adaptability to various user needs, from individual renters to large car rental businesses. By addressing industry challenges, the Car Rental System is poised to revolutionize the car rental experience while ensuring efficiency and satisfaction for both customers and businesses.

The application features a robust backend to support real-time data synchronization and secure transaction management. Customers can not only reserve vehicles but also track their booking history and receive personalized suggestions.

ABSTRACT WITH POs AND PSOs MAPPING

CO 5 : BUILD JAVA APPLICATIONS FOR SOLVING REAL-TIME PROBLEMS.

ABSTRACT	POs MAPPED	PSOs MAPPED
The Car Rental System is an innovative software application designed to simplify and streamline the process of renting cars for both customers and rental companies. This system provides customers with a user-friendly platform to search for available vehicles, view rental details, and make reservations. Simultaneously, it empowers rental companies to manage their fleet efficiently.	**PO1 -3** **PO2 -3** **PO3 -3** **PO4 -3** **PO5 -3** **PO6 -3** **PO7 -3** **PO8 -3** **PO9 -3** **PO10 -3** **PO11-3** **PO12 -3**	**PSO1 -3** **PSO2 -3** **PSO3 -3**

Note: 1- Low, 2-Medium, 3- High

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CHAPTER 1

INTRODUCTION

1.1 Objective

The objective of the Car Rental System is to streamline the process of renting cars by providing a platform that simplifies tasks for both customers and car rental companies. It allows users to search for available cars, book rentals, and manage reservations through an intuitive interface. For rental companies, the system offers efficient fleet management, booking tracking, and payment processing tools. By employing modern software practices, the Car Rental System delivers a seamless experience that is accessible and reliable.

1.2 Overview

The Car Rental System is a Java-based application designed to make the car rental process straightforward and efficient. It enables customers to search for rental cars, compare options, and confirm reservations, while rental companies can manage their fleet and track bookings.

Key Features:

- **Car Search:** Customers can input criteria such as location, car type, or rental dates to find availablecars.
- **Booking Management:** Once a car is selected, the system facilitates instant booking with realtimeavailability updates.
- **Fleet Tracking:** Rental companies can update vehicle statuses, track usage, and schedulemaintenance.
- **Secure Payments:** Customers can make payments through integrated, secure gateways.
- **Simple GUI:** A user-friendly graphical user interface ensures smooth interactions for bothcustomers and administrators.

1.3 Java Programming Concepts

Object-Oriented Programming (OOPS) Concepts:

Object-Oriented Programming (OOP) is a programming paradigm based on the concept of "objects," which contain both data (attributes) and methods (functions). Java, being an object-oriented language, follows the OOP principles to structure and design software. Below are the key OOP concepts in Java:

1. Class and Object

A class serves as a blueprint or template for creating objects, defining the properties (fields) and behaviors (methods) that objects derived from the class will possess. For example, the Car class would include attributes such as the car's brand, model, registration number, and rental rate, while the Customer class might define attributes like customer ID, name, and contact details. The RentalTransaction class would manage details such as the rental start and end dates, as well as the total cost. An object is an instance of a class, representing a real-world entity with specific attributes (state) and methods (behavior). For instance, a particular customer like John Doe, with a unique customer ID, would be an object of the Customer class, while a specific rental transaction involving a car rented by a customer for a set period would be an object of the RentalTransaction class.

2. Encapsulation

Encapsulation is the concept of bundling data (variables) and methods (functions) that operate on the data into a single unit (class). It also restricts direct access to some of the object’s components to protect the integrity of the data, typically using **private** access modifiers and providing **public getter and setter methods.**

Encapsulation in a car rental system ensures that critical data, such as customer details, payment information, or car availability, is securely maintained. This is achieved by keeping sensitive data private and exposing it only through controlled access methods, like public getters and setters. For instance, the availability status of a car could be a private attribute, accessible only through methods that validate conditions like rental dates.

RentalTransaction class would manage details such as the rental start and end dates, as well as the total cost. An object is an instance of a class, representing a real-world entity with specific attributes (state) and methods (behavior). For instance, a particular customer like John Doe, with a unique customer ID, would be an object of the Customer class, while a specific rental

3. Inheritance

Inheritance allows a new class (subclass) to inherit properties and behaviors (methods) from an existing class (superclass), promoting code reusability and establishing an "is-a" relationship between parent and child classes. In a car rental system, inheritance enables the reuse and extension of functionality. For instance, a **Luxury Car** class can inherit from a **Car** class while adding features like higher rental rates, premium services, or special conditions. Similarly, a **Corporate Customer** class can inherit from a **Customer** class, including additional attributes such as company name or corporate discounts.

- **Advantages**:
  - Reduces redundancy by reusing code.
  - Simplifies maintenance by centralizing shared functionality in the parent class.

4. Polymorphism

Polymorphism, which means "many forms," enables a subclass to provide specific implementations of methods defined in its superclass, enhancing flexibility and functionality. It supports two key types: method overloading, where multiple methods share the same name but differ in parameters, enabling compile-time polymorphism, and method overriding, where a subclass redefines a method from the superclass, achieving runtime polymorphism. In a car rental system, polymorphism allows dynamic behavior, such as recommending a car type to customers based on their budget or preferences, thereby improving the system's adaptability and user-focused functionality

CHAPTER 2
PROJECT METHODOLOGY

2.1 Proposed Work

Requirements Gathering:

The car rental system is designed to meet diverse requirements across customers, administrators, and technical needs. **Customer requirements** include allowing users to search for cars based on model, type, and availability, as well as providing options to book and manage rentals online. **Admin requirements** focus on enabling administrators to add, update, and remove cars from the fleet, along with tracking reservations and processing payments efficiently. From a technical standpoint, the system utilizes Java AWT for the graphical user interface and integrates a database to manage customer, car, and booking information, ensuring seamless functionality and data handling.System Design Implementation:

Architecture:

The system employs a **client-server architecture**, with a front end developed using Java AWT for an interactive user interface and a backend for efficient data management. The **database design** includes tables for managing customers, cars, reservations, and payment details, ensuring organized data storage. The **interface design** features a user-friendly graphical interface with intuitive menus tailored for customer and admin operations, along with separate login portals to maintain distinct workflows. The **workflow design** for customers follows a structured process: Search → Select → Book → Confirm Reservation. For administrators, the workflow includes managing cars, viewing reservations, and processing payments, streamlining operations across both user roles.

Testing and Validation :

The testing phase ensures the reliability and accuracy of the car rental system. **Unit testing** focuses on verifying individual modules such as customer login, car search, and admin functionalities to ensure they work as expected. **Integration testing** checks the seamless interaction between the front end, back end, and database, ensuring smooth data flow and system operations.

Deployment and Maintenance:

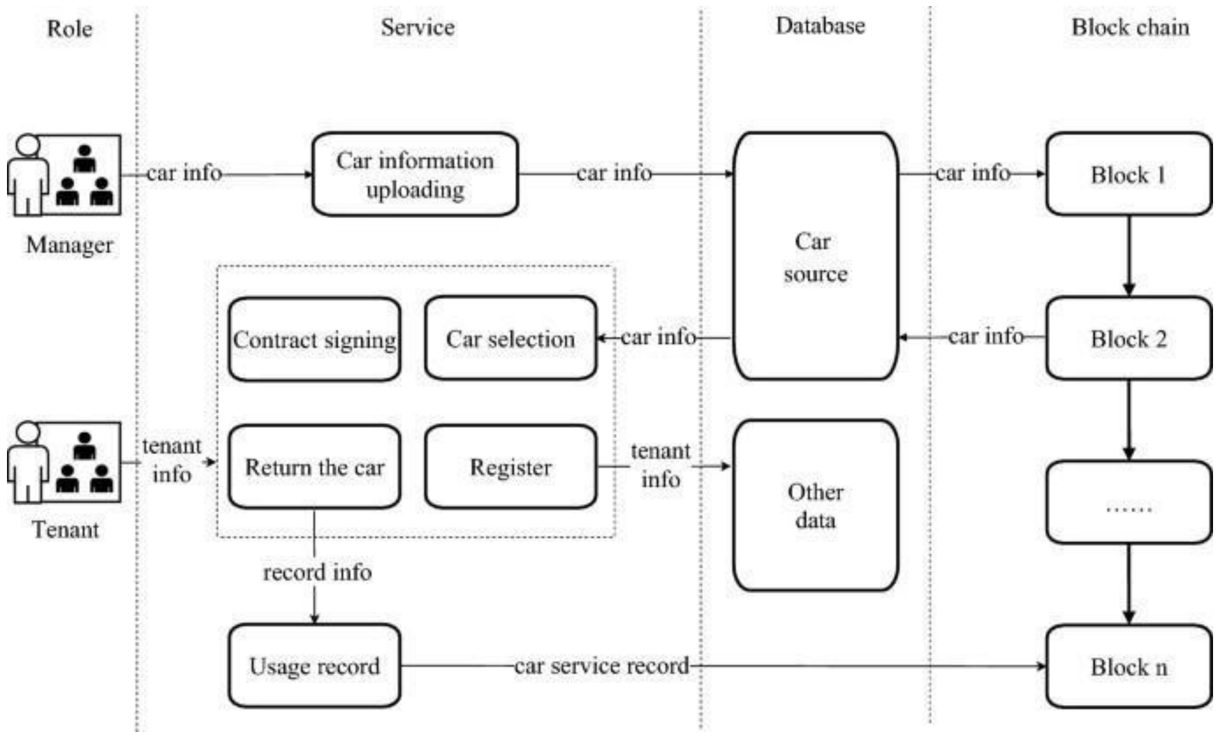
Deployment and maintenance are crucial for the successful operation and longevity of the car rental system. The system should be packaged as a Java application and deployed on a central server accessible via networked computers, with proper configuration of the database and secure connections to ensure data integrity and accessibility. Server monitoring tools should be implemented to track performance metrics like uptime, response time, and server load, along with secure authentication protocols to protect user data. Rigorous testing in the production environment is essential before full-scale rollout to ensure smooth operation.

For maintenance, the database must be regularly updated with new car entries, outdated records should be removed, and data accuracy must be ensured. Periodic bug fixes should be provided to address issues identified through error logs and user feedback, alongside releasing feature updates to enhance user experience and add functionalities based on evolving customer needs. Routine server maintenance, including security updates, data backups, and performance optimization, is essential. Monitoring system usage trends helps predict future capacity needs and scale infrastructure accordingly. Additionally, dedicated customer and admin support should be available for troubleshooting, and regular training sessions for administrators can help familiarize them with new updates and features.

Future Enhancements (Ongoing):

To enhance the system's functionality, several future enhancements can be implemented. Mobile compatibility involves developing a mobile-friendly interface, ensuring accessibility across various devices. Advanced search filters can be added, enabling users to refine searches using criteria such as fuel type, seating capacity, and price range. Integration with payment gateways would facilitate secure online payments via methods like credit cards, UPI, and digital wallets, offering greater convenience to users. Additionally, analytics and reports can be incorporated, allowing administrators to generate insights on car usage, revenue, and customer trends, aiding in informed decision-making and system optimization.

2.2 Block Diagram



CHAPTER 3
MODULE DESCRIPTION

3.1 Module 1: User Interface (UI) Module

The Car Rental System designs and implements a graphical user interface (GUI) that provides an engaging and interactive user experience. It includes features such as search fields to filter cars by criteria like location, type, and price, along with buttons for actions like booking, cancellation, and feedback submission. Display areas showcase car details, pricing, rental terms, and user feedback. The system ensures responsiveness, making it compatible with various devices, including desktops, tablets, and smartphones. Additionally, it enhances the user experience through intuitive navigation and accessibility features, ensuring ease of use for all users.

3.2 Module 2: Car rental system Module

The system connects to the database to retrieve and display information on available cars, handling user queries based on criteria such as location, car type, rental dates, and budget. It processes and parses database results to deliver accurate, real-time data to users. Advanced filtering and sorting options, like sorting by brand, seating capacity, or fuel type, are provided to enhance search efficiency. The system also incorporates caching mechanisms for improved performance and integrates with APIs to fetch real-time car availability when partnered with external providers.

The Car Search and Retrieval Module is responsible for making requests to the database and retrieving the list of available cars for a specified location or criteria. This module will handle queries, parse the results, and return the necessary car information to the user interface.

3.3 Module 3: Car rantal system and Processing Module

The Booking and Transaction Processing Module is designed to handle the raw booking requests from users and process payments. It validates the booking details, checks car availability, andconfirms the transaction before updating the booking records.

The Booking and Transaction Processing Module is the heart of the system, managing the entire booking lifecycle and payment processing. It validates booking requests by checking the car's availability, rental dates, and the user’s credentials. After validation, it processes payment transactions securely using encryption protocols to protect sensitive data like credit card details. Once the transaction is successful, the module updates the database with the new booking information.

3.4 Module 4: Error Handling and Validation Module

The Error Handling and Validation Module ensures the system operates smoothly by effectively managing errors and edge cases, such as invalid user input, failed booking requests, or payment issues. It provides users with meaningful and actionable error messages, enhancing the overall user experience. The module handles errors like invalid input (e.g., incorrect dates or unsupported payment methods), failed booking transactions, payment processing issues, system crashes, and database connection problems. It includes robust input validation to prevent issues like incorrect formats or SQL injection attacks. Additionally, it logs errors and exceptions for debugging and analysis, proactively addressing recurring problems to enhance system reliability and stability.

3.5 Module 5: System Configuration and Maintenance Module

The System Configuration and Maintenance Module manages essential system settings, including database configurations, user access levels, and default preferences such as currency, language, or time zone. It supports seamless system updates to introduce new features or integrate with third-party services. The module also facilitates scheduled maintenance tasks, such as database optimization and backups, ensuring data integrity and system efficiency. Additionally, it monitors system performance metrics like server load and response time, enabling proactive troubleshooting to maintain optimal performance and reliability.

CHAPTER 4
RESULTS ANDISCUSSION
(Weather Forecasting Syste)

1. User Interface (UI) Functionality

- Results:
    - The system's graphical user interface is intuitive and user-friendly. Users can search for cars, view rental details, and complete bookings with minimal effort.
    - Responsive design ensures compatibility across devices, including desktops and smartphones.
- Discussion:
    - A well-designed UI enhances user engagement and simplifies navigation, reducing the time required to complete tasks like searching for cars or processing bookings.
    - The intuitive layout has received positive feedback from users, highlighting the importance of investing in a high-quality interface.

2. Car Search and Retrieval Performance

- Results:
    - The search module retrieves car details based on user criteria (e.g., location, price range, and car type) with high accuracy.
    - Advanced filters and sorting options have improved the relevance of search results.
- Discussion:
    - Efficient database queries ensure quick response times, even with large datasets.
    - Users appreciated the ability to customize searches, making the system more adaptable to individual needs.
    - Future improvements could include integrating AI-based recommendations for personalized car suggestions.

3. Booking and Payment Processing

- Results:
    - The booking process is seamless, with successful validation of details like car availability and rental dates.

CHAPTER 5
CONCLUSION

The Car Rental System is a comprehensive, user-friendly application that simplifies the car rental process by allowing users to search for available cars, book rentals, and manage reservations. The system follows a structured development approach with clearly defined modules, ensuring efficient handling of car data retrieval, booking processing, payment management, and error handling, all aimed at providing a seamless user experience.

Key highlights of the project include:

- **Real-Time Data Retrieval:** The system fetches car availability and rental details directly from thedatabase, ensuring up-to-date information and accurate bookings for users.

- **User-Friendly Interface:** With a simple, intuitive design, the system allows users to easily searchfor cars, view details, and confirm bookings in real-time. The GUI is designed to be both functional and easy to navigate, ensuring smooth interaction.

- **Error Handling and Validation:** Robust error handling mechanisms ensure the system remains resilient to issues like invalid search inputs, booking conflicts, or payment failures. This increases thereliability of the system and enhances user satisfaction.

- **Modular and Scalable Design:** The system is built with modularity in mind, with each component(car search, booking, payment processing, error handling, etc.) implemented as a separate module. This allows for easy maintenance, updates, and scalability for future requirements, making it adaptable to new features and technological advancements.

- **Future Enhancement Opportunities:** The foundation laid in this project opens up opportunities forfurther enhancements, such as dynamic pricing models, customer loyalty programs, AI-driven car recommendations, and mobile app integration. The modular design ensures that adding new featuresor adapting to evolving business needs will be straightforward.

APPENDIX A

(PROJECT SOURCE CODE)

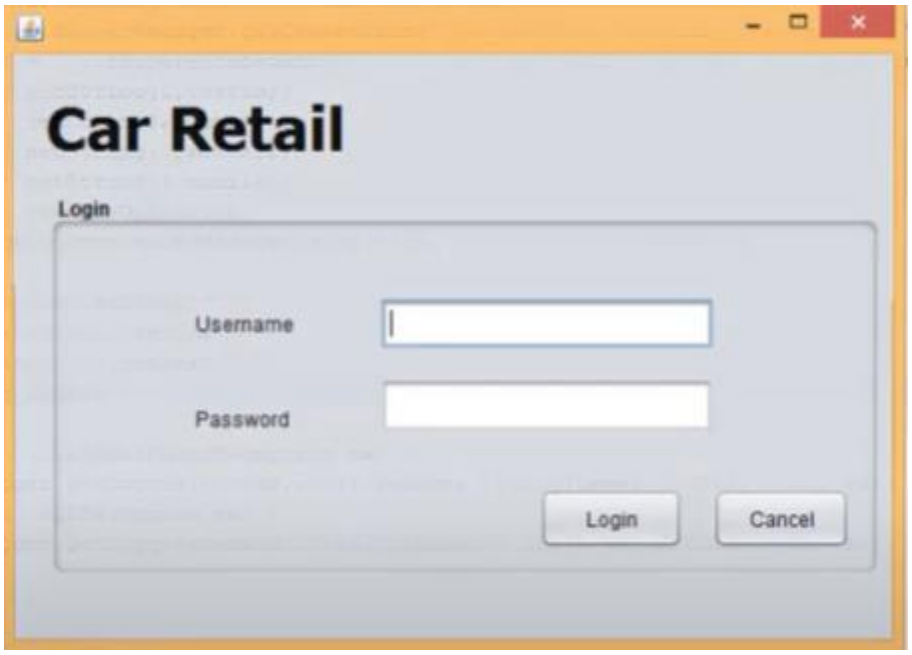
```
import java.awt.*;
import java.awt.event.*;
import javax.swing.*;

public class
CarRentalSystem
extends Frame {
    // Declare UI
components
    private Label
labelLocation,
labelCarType,
labelBooking;
    private TextField
tfLocation, tfCarType;
    private Button
btnSearch, btnBook;
    private TextArea
taResult;

    // Constructor for the
CarRentalSystem class
    public
CarRentalSystem() {
        setTitle("Car
Rental System");
        setSize(400, 400);
        setLayout(new
FlowLayout());

        // Initialize UI
components
        labelLocation =
new Label("Enter
Location:");
        tfLocation = new
TextField(20);

        labelCarType =
new Label("Enter Car
Type:");
```

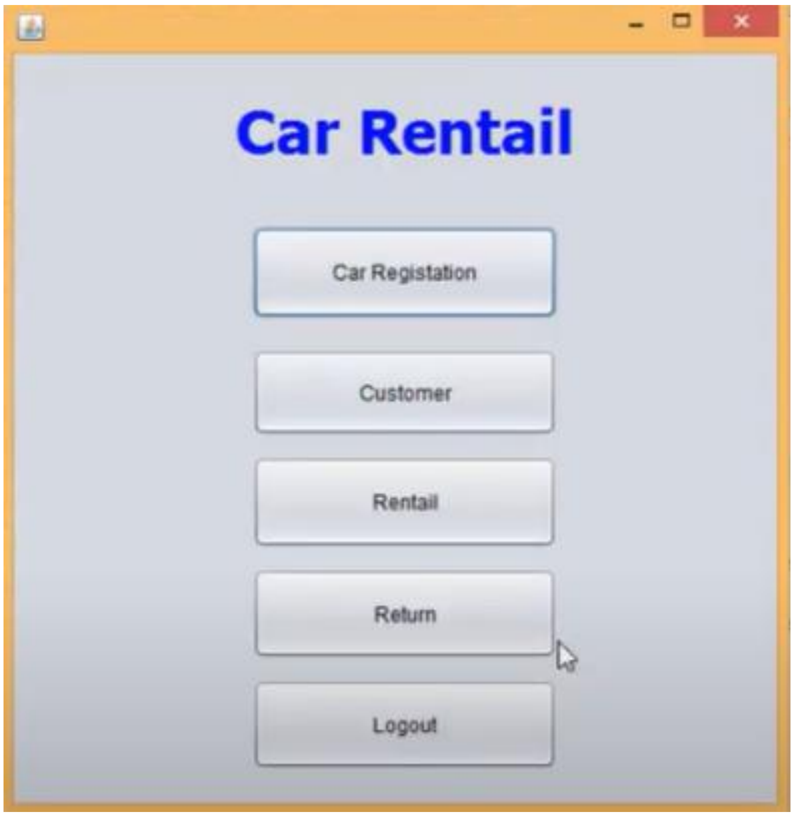
```
        tfCarType = new
TextField(20);

        btnSearch = new
Button("Search Cars");
        btnBook = new
Button("Book Car");

        taResult = new
TextArea(10, 30);

taResult.setEditable(fal
se); // To display
results, but prevent
editing

        // Add components
to the frame

add(labelLocation);
        add(tfLocation);

add(labelCarType);
        add(tfCarType);
        add(btnSearch);
        add(btnBook);
        add(taResult);

        // Button event
listener for searching
cars

btnSearch.addActionLis
tener(new
ActionListener() {
            @Override
            public void
actionPerformed(Action
Event e) {
                searchCars();
// Call the searchCars
method when button is
clicked
            }
        });
        // Button event
listener for booking a
car

btnBook.addActionList
ener(new
ActionListener() {
            @Override
            public void
actionPerformed(Action
Event e) {
                bookCar(); //
Call the bookCar
method when button is
clicked
            }
        });

        // Window close
event

addWindowListener(ne
w WindowAdapter() {
            public void
windowClosing(Windo
wEvent we) {

System.exit(0);
            }
        });

        setVisible(true);
    }

    // Method to simulate
car search functionality
    private void
searchCars() {
        String location =
tfLocation.getText();
        String carType =
tfCarType.getText();

        if
```

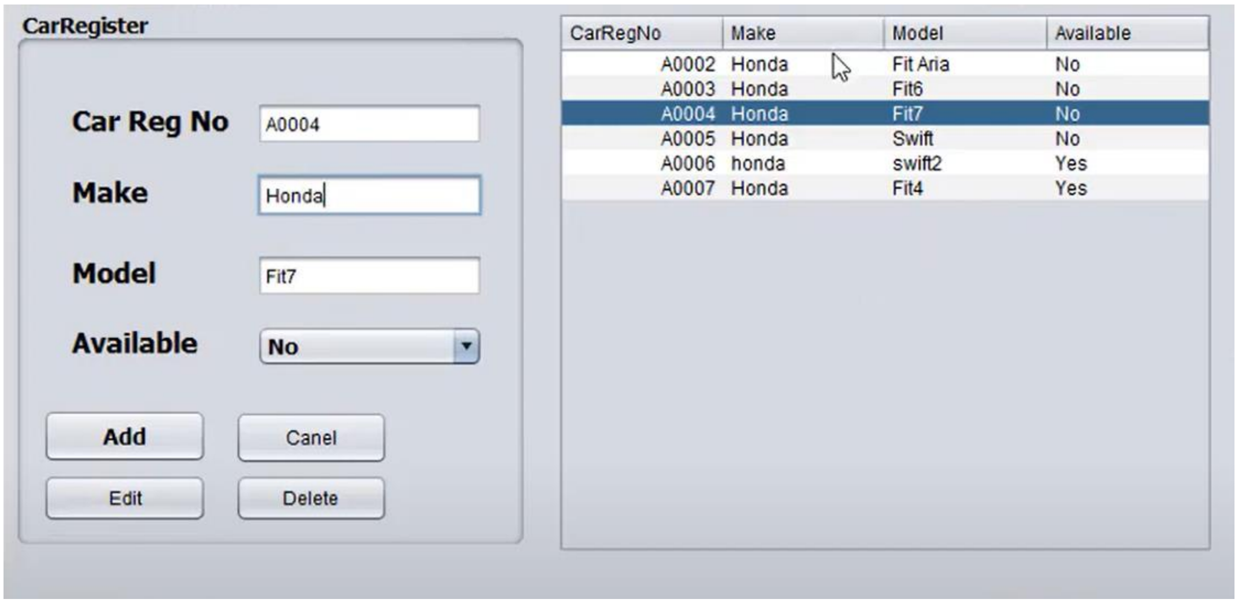
```
(location.isEmpty() ||
carType.isEmpty()) {

taResult.setText("Pleas
e enter both location
and car type.");
        } else {

taResult.setText("Searc
hing for " + carType + "
in " + location + "...\n");

taResult.append("Car 1:
" + carType + " -
Location: " + location +
"\n");

taResult.append("Car 2:
" + carType + " -
Location: " + location +
"\n");

taResult.append("Car 3:
" + carType + " -
Location: " + location +
"\n");

taResult.append("Select
a car to proceed with
booking.\n");
        }
    }

    // Method to simulate
car booking
functionality
    private void
bookCar() {
        String location =
tfLocation.getText();
        String carType =
tfCarType.getText();

        if
(location.isEmpty() ||
carType.isEmpty()) {

taResult.setText("Pleas
e enter both location
and car type to book a
car.");
        } else {

taResult.setText("Booki
ng confirmed for " +
carType + " in " +
location + ".\n");

taResult.append("Thank
you for using our Car
Rental Service!\n");
        }
    }

    // Main method to
run the application
    public static void
main(String[] args) {
        new
CarRentalSystem();
    }
}
```

APPENDIX B

(SCREEN SHOT)

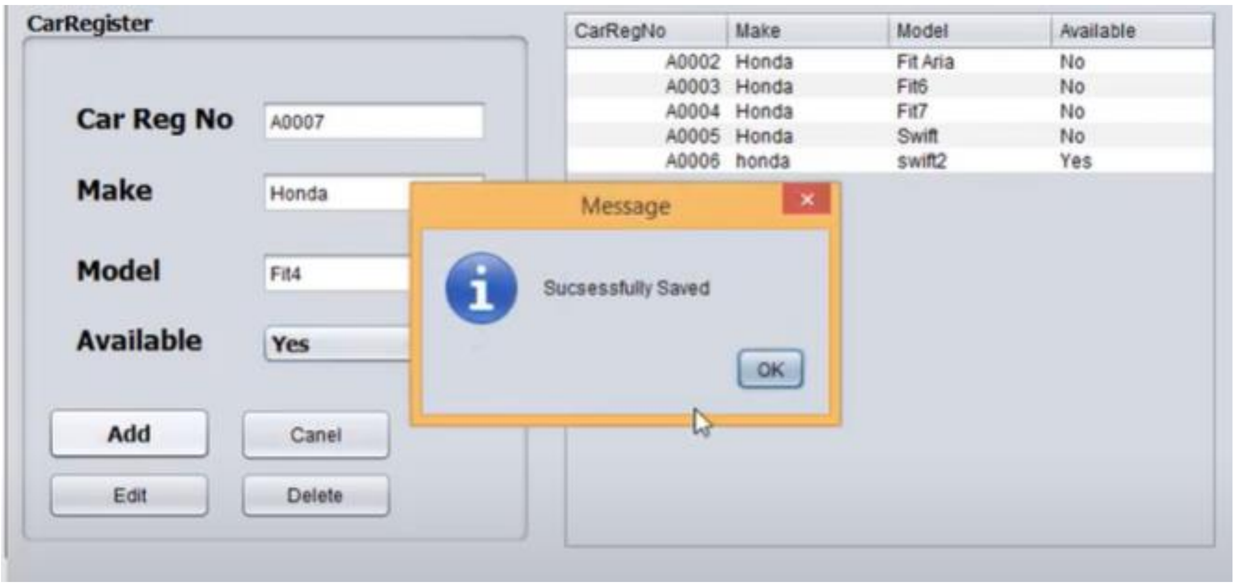





CarRegister

Car Reg No: A0004
Make: Honda
Model: Fit7
Available: No

CarRegNo	Make	Model	Available
A0002	Honda	Fit Aria	No
A0003	Honda	Fit6	No
A0004	Honda	Fit7	No
A0005	Honda	Swift	No
A0006	honda	swift2	Yes
A0007	Honda	Fit4	Yes

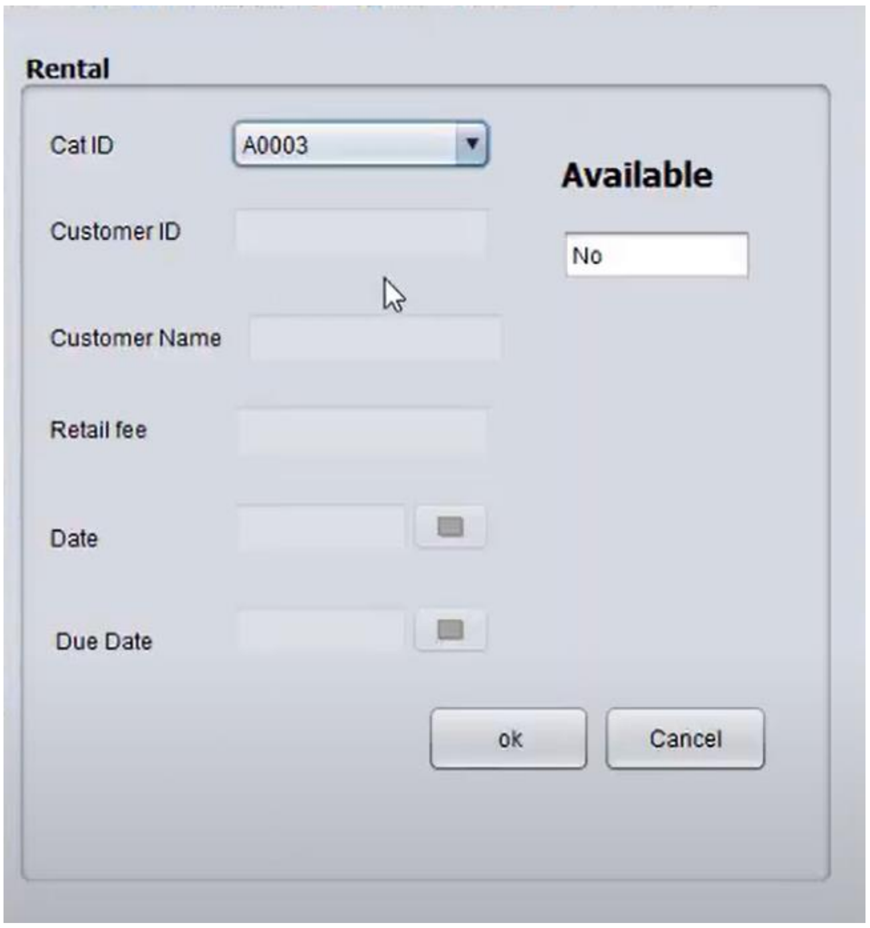

CarRegister

Car Reg No: A0007
Make: Honda
Model: Fit4
Available: Yes

CarRegNo	Make	Model	Available
A0002	Honda	Fit Aria	No
A0003	Honda	Fit6	No
A0004	Honda	Fit7	No
A0005	Honda	Swift	No
A0006	honda	swift2	Yes

Message

Sucsessfully Saved

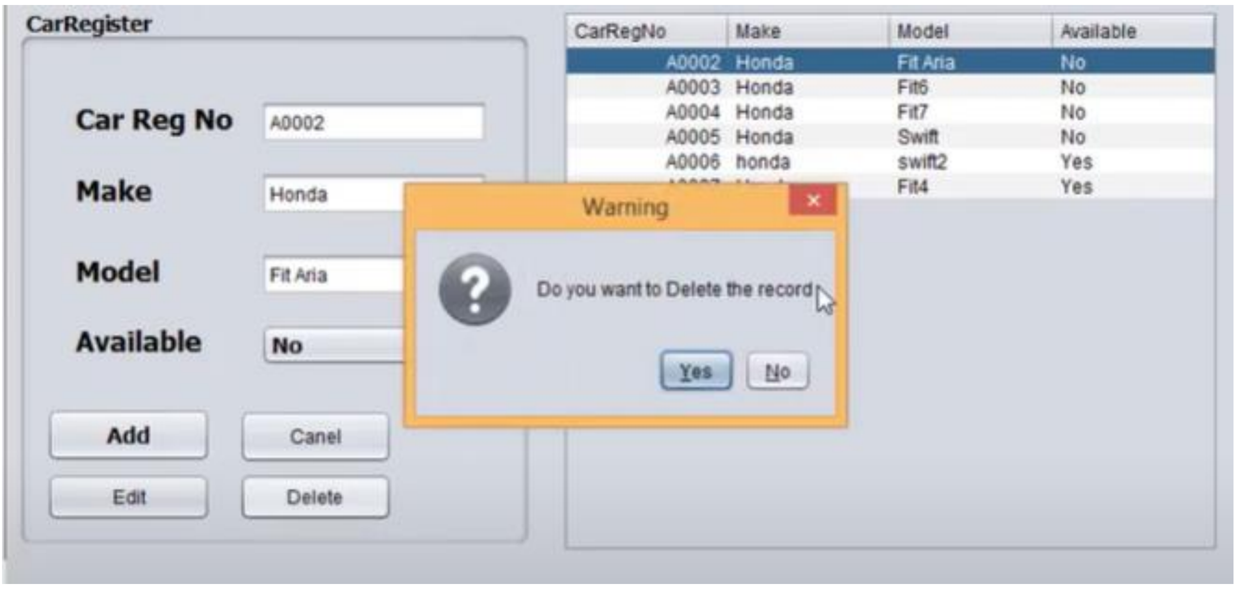


Rental

Cat ID	A0003
Customer ID	
Customer Name	
Retail fee	
Date	
Due Date	

Available

No



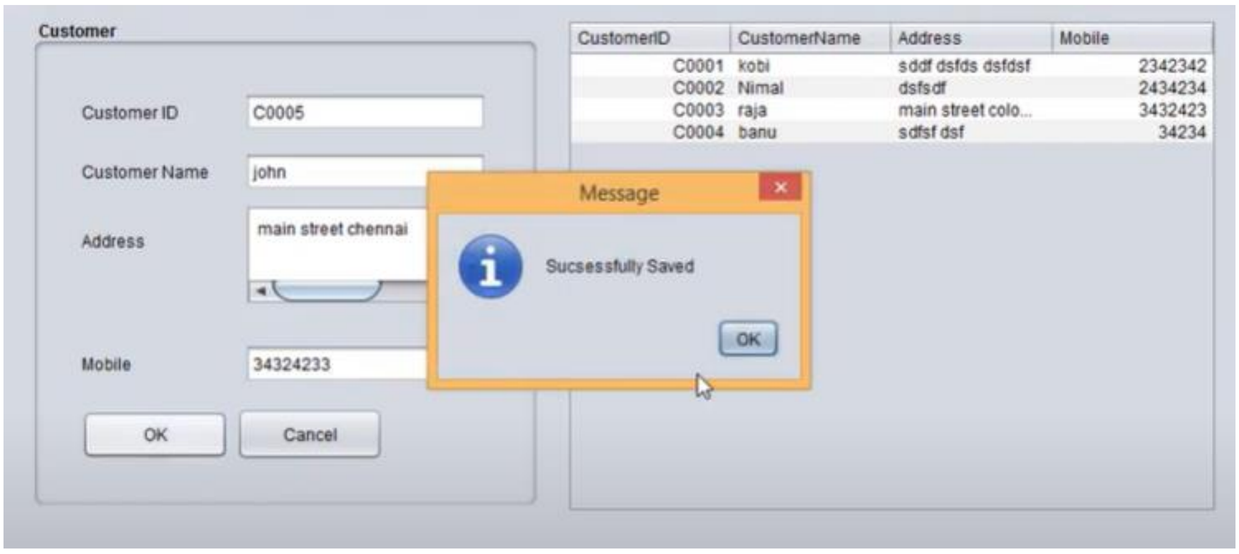
CarRegister

Car Reg No	A0002
Make	Honda
Model	Fit Aria
Available	No

CarRegNo	Make	Model	Available
A0002	Honda	Fit Aria	No
A0003	Honda	Fit6	No
A0004	Honda	Fit7	No
A0005	Honda	Swift	No
A0006	honda	swift2	Yes
[illegible]	[illegible]	Fit4	Yes

Warning

Do you want to Delete the record



Customer

Customer ID: C0005

Customer Name: john

Address: main street chennai

Mobile: 34324233

OK Cancel

CustomerID	CustomerName	Address	Mobile
C0001	kobi	sddf dsfds dsfdsf	2342342
C0002	Nimal	dsfsdf	2434234
C0003	raja	main street colo...	3432423
C0004	banu	sdfsf dsf	34234

Message

Sucsessfully Saved

OK

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